# THE EVOLUTION OF RESEARCH AND DEVELOPMENT ON CONVENTIONAL VARIETIES IN BRAZIL 2003-2009 CULTIVARS INSTITUTIONAL FRAMEWORK AND AGROBIODIVERSITY MENACES IN BRAZIL

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# THE EVOLUTION OF RESEARCH AND DEVELOPMENT ON CONVENTIONAL VARIETIES IN BRAZIL 2003-2009

## CULTIVARS INSTITUTIONAL FRAMEWORK AND AGROBIODIVERSITY MENACES IN BRAZIL

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**Abstract** — The aim of this paper is to discuss the role of cultivar protection regulations in the availability of conventional seeds in Brazilian agriculture. The expansion of intellectual property rights has stimulated innovative research on breeding in Brazil, mainly on the biotech applications, but this may constitute a challenge to the adoption of policies aiming to preserve agrobiodiversity. The institutional apparatus tends to reward standardization and homogeneity, favoring the concentration of the seeds market and the establishment of segmented forms of agriculture. The advent of biotech crops at the beginning of this century has accentuated this tendency and has also contributed to a reduction of conventional plant breeders. The extension of property rights in biotechnology and seed technology, with the establishment of patents in plant breeding and seed supply, certainly reward investments on research and innovation; but on the other hand they reduce the access of many farmers to conventional cultures, leading to a loss in agrobiodiversity.

**Key words:** property rights, genetic breeding, agrobiodiversity, Brazil

**Résumé** — L'objectif de ce document est de discuter le rôle de la réglementation de la protection des cultivars sur la disponibilité des semences conventionnelles dans l'agriculture brésilienne. L'expansion des droits de la propriété intellectuelle a stimulé la recherche et l'innovation sur l'amélioration génétique, surtout sur les applications de la biotechnologie, mais elle peut aussi constituer un défi à l'adoption des politiques qui essayent de préserver l'agrobiodiversité. Le cadre institutionnel tend à récompenser la standardisation et l'homogénéité, favorisant la concentration du marché et l'existence des agricultures segmentées. L'arrivée de cultures biotechnologiques au début de ce siècle n'a fait qu'accentuer cette tendance et a aussi contribué à réduire la capacité d'amélioration des cultures conventionnelles. L'expansion des droits de propriété sur la biotechnologie et sur la technologie des semences d'une façon générale, certainement récompense les investissements dans la recherche et innovation, mais par contre, réduit l'accès de beaucoup d'agriculteurs aux cultures conventionnelles, en contribuant à la réduction de l'agrobiodiversité.

**Mots clés :** propriété intellectuelle, amélioration génétique, agrobiodiversité, Brésil

## INTRODUCTION

The expansion of intellectual property rights has stimulated innovative research on breeding in Brazil, mainly concerning the biotech applications, but may constitute a challenge to the adoption of policies aiming to preserve agrobiodiversity. The legal apparatus tends to reward standardization and homogeneity, favoring the concentration of the seed market and the establishment of segmented agricultures.

The decline in agricultural biodiversity due to the standardization and reduction of species and varieties has been widely debated for decades. The increased number of patents and, consequently, the obligation of royalty payments undoubtedly protects and stimulates research on breeding and genetic engineering, but has a wide range of effects on biodiversity. In the long term, this tendency may lead to a decrease in the genetic variability of crops. These concerns have resulted in a great number of publications and have led to political debates and action everywhere.

In Brazil, the institutional arrangements were implemented to protect genetic and breeding research in the first years of the agricultural modernization process in the sixties, when international groups entered the agroindustrial sector. During the 1990s, political pressure was applied in an attempt to introduce regulations in conformance with the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPs) of the World Trade Organization (WTO). In 1996, a bill for a patent law was approved, extending monopoly rights in intellectual property to food-related cases. That same year, procedures regarding the Cultivar Law were initiated, conceding rights of cultivar monopoly to firms devoted to genetic modification. Both laws came into force in 1997.

The advent of biotech crops in the early twenty-first century has accentuated this tendency, also contributing to a reduction in the number of conventional plant breeders. The increase of property rights in biotechnology and seed technology, especially the establishment of patents in plant breeding and seed supply. Patents and royalties certainly reward investments in research and innovation. However, on the other hand, they reduce the access of many farmers to conventional seeds.

This paper is divided into three parts: The first connects the institutional framework with the spread of patented seeds; the second highlights the major expansion of GM crops as a consequence, and the third part attempts to describe some consequences on the availability of conventional seeds.

## 1. THE INSTITUTIONAL CONTRIBUTION TO THE SPREAD OF PATENTED SEEDS

There are basically 4 laws and a provisional measure that constitute the regulatory framework for improved and certified seed development in Brazil: the Patent Law (Law no.9.279, dated 05/14/96) and the Cultivar Protection Law (Law no. 9.456, dated 04/25/97) deal basically with issues related to intellectual property. The Seed Law (Law no. 10.711, 08/05/03) deals with the production and sale of seeds, while the Biosafety Law (Law 11.105, dated 24/03/2005) deals with GM seeds. The Provisional Measure (MP) 2.186-16, in 2001, regulates access to and the collection of Brazilian genetic patrimony.

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### 1.1 Patent Law

Law No. 9279/96, which regulates property industry in Brazil, came into force in 1997. This law replaced the old 1971 patents law. By the Patents Act of 1996, medicine and food recognized as inventions, as well as biotechnological processes arising from new biotechnology (GMOs), are eligible to be patented.

The definition of a legal framework for the commercial use of GMOS and the restricted access to genetic material provided for by the Cultivar and Seed Laws encouraged

multinational groups to acquire Brazilian firms. Among these were the 1996 acquisition of FT Sementes, leading company in the soy sector, and that of Agroceres, the largest Brazilian seed firm at the time, in the corn sector in 1997 by the Monsanto Company. In 1998, the Dow AgroScience company bought four Brazilian companies, and Monsanto acquired part of another three multinationals that were active in Brazil. In 1999, the Agrevo Company, later acquired by Bayer, bought three Brazilian firms that operated in the corn and soy business. In that same year, DuPont bought a Brazilian firm in the corn sector, in addition to the corn sector of Pioneer, which had been operating in Brazil since the 1970s. In 2005, Nidera acquired 100% of Bayer's property in soy and corn programs in Brazil. In 2007, Dow AgroScience bought Agromen's seed division (which at that time held 11% of the national market in corn seeds). Also in 2007, Monsanto acquired 100% of Agroeste, another Brazilian firm that was also a leader in the hybrid corn seed sector. [1]

Processes of market concentration are growing and continuous in this sector. In 2008 and 2009 the biotechnology multinationals in Brazil entered the biofuel market with Monsanto's acquisition of CanaVialis and Alellyx, the former belonging to Votorantin Novos Negócios. (Rocha dos Santos, 2009)

## 1.2 Cultivar Law

The Cultivar Protection Law has been legitimized by costly, long-term research on genetic improvement, mainly of autogamous plants, whose breeding may get out of control. The legal framework not only protects cultivars but also guarantees sustainability and returns on research investments.

Prior to the approval of the Cultivar Protection Law (LPC) in April of 1997, cultivars were in the public domain, with free access to cultivars as raw material for programs of seed multiplication and trade. Throughout the implementation of this law, there were several controversies over the patenting of live organisms, but the arguments in favor of their release were: (i) the guarantee and sustainability of research through strengthening Intellectual Property of vegetable varieties; (ii) the guarantee of competitiveness in the generation of agricultural technologies; (iii) the possibility of attracting private national and international investment in research on genetic improvement; (iv) the combating of seed piracy; (v) reduction of vulnerability in protecting species characterized by vegetative reproduction.

After the LCP had been passed, genetic improvement firms began to receive a Protection Certificate, hereinafter requiring licenses for the commercial use of cultivars. According to Carraro (2005), the LCP has completely transformed the autogamous seed market in Brazil. It has resulted in the establishment of a new business environment, obliging technology transfer and the relation between licensed breeders to become formally contractual. Therefore, a registered cultivar can only be appropriated through prior authorization from the license holder and requires royalty payments.

In addition to the LCP, which is managed by the National System of Cultivar Protection (SNPC) linked to international regulations on intellectual protection (TRIPS), the National Cultivar Registry (RNC) was also created. The SNPC's purpose is to protect intellectual property, which has its own legislation guaranteeing rights to when cultivars are used for commercial purposes, i.e. it authorizes the collection of royalty payments. The NCR, in its turn, is based on the Seed Law, and certifies cultivars for production and commercialization, i.e., it does not guarantee property rights. Rather, it provides the legal bases that underlie the entire chain of seed production.

The NCR has a current registry of approximately 23,000 cultivars, while the SNPC has 1,400 (genetically modified and conventional) ones that are protected through patents

[1] Cordeiro, Perez and Guazzelli, 2007

and registered, more than half of which belong to the *Glycine max* (L.) species. (MAPA, 2009)

Cultivar protection, in this case, is exercised over reproductive material or over the vegetative multiplication of the whole plant. This protection guarantees the owner's right to reproduce the cultivar throughout Brazil, while impeding its use by a third party for commercial purposes, as well as denying privileges for commercializing or selling cultivar reproduction material without the owner's permission during the period in which protection is in effect.

It should be emphasized that there are exceptions to the owner's rights: (i) use or sale of the product obtained from the crop as food or raw material; (ii) keeping and planting seeds for one's own use; (iii) a family farmer's multiplication of seeds for donation or exchange and (iv) use of the cultivar as a source of variation in genetic improvement and scientific research. Furthermore, according to the LCP, rights are revoked when the stipulated protection period comes to an end. Cultivars also enter the public domain when the intellectual property right owner renounces them, or when certification is cancelled. The latter occurs when there is a loss of product homogeneity or stability, when annuities are not paid, or when a live sample is not duly provided or when a product has had a harmful impact on the environment. It is also necessary to point out that GM cultivars protected by the LCP are entitled to a technology license and royalty payments while the utilization of NGM cultivars are royalty-free.

After the creation of the LCP, there were several transformations in the agricultural input market, and due to the introduction of new technologies, even more are expected. According to Vieira (2003), immediately following the approval of the law there was a 10% increase in programs for the improvement of autogamous plants (cotton, rice, soy, wheat and beans) and public investments remained stable or fell, while private investments as much as tripled, a point in question being a 200% increase in the launching of autogamous plant cultivars (VIEIRA, 2003).

The LCP has been criticized by associations of family farmers and by environmentally-sound agriculture entities, such as the AS-PTA (Advisory and Services Committee for Alternative Agriculture Projects). This entity believes that the norms and regulatory mechanisms established by the LCP for registered seed production have made it easier for large firms to exercise control over markets and establish barriers blocking the presence and entry of farmers' cooperatives and small firms into circuits of mercantile production. After the LCP had been passed, the few organizations of organic family farmers that existed in the Brazilian market were faced with monumental difficulties that posed a threat to their ability to continue their economic activities[2]. In effect, with the LCP, the cooperatives have lost their position as a source of lower cost seeds, since royalty payments had to be included in their production costs.

As expected, the informal market has been adversely affected. Small farmers have become directly dependent on the seed industry which, in turn, incorporates all chemical and biological inputs; otherwise, they are restricted to an old genetic base which is not under LCP jurisdiction and is consequently subjected to increasing disadvantages in terms of productivity and adaptability.[3]

**1.3 The Seed Law:**

[2] WAR ON WANT and AS-PTA, set.2008. p.3
[3] *Wilkinson, 2001*

The first legal framework for seed production in Brazil emerged in 1965, when norms for seed trade control were established. Inspection and control of seed trade regulations were established ten years later and then remain unchanged until 2003, when Law n° 10.771 was promulgated on 08 May, 2003[4] creating the National System of Plants and Seeds (SNSM). The Ministry of Agriculture, Fishing and Supplying – MAPA) is the promoter, coordinator, policy maker, supervisor, auditor and supervisor of actions resulting from SNSM codes, the Seed Law and its regulation. It is up to the Federation states to elaborate norms and complementary procedures regarding the production of plants and seeds, as well as to carry out inspections of state-wide trade. Inspection and trade in seed and plant commerce is carried out by the MAPA whenever solicited by the federal government. This law also recognizes landraces selected by farmers and Indians, legalizing exchange between communities. With the Seed Law, the control over seed quality (certification), which was exclusively made by public bodies, can now also be conducted by private institutions.

## 2. THE BIOSAFETY LAW AND GMO SEEDS

The Biosafety Law[5] regulates planting, commercialization and research on genetically modified seeds. It attributes to the National Technical Commission on Biosafety (CTNBio[6]) the policy for GM seeds in Brazil The CTNBio *"is a multidisciplinary collegiate body, whose purpose is to provide technical support and consultative advice to the Federal Government in the formulation, updating and implementation of National Biosafety Policy for GMOs, establishing safety standards and technical advice about the human health protection, living organisms and the environment, on activities involving construction, experimentation, cultivation, manipulation, transportation, marketing, consumption, storage, release and disposal of GMOs and their derivatives"*[7] The commercial release of GMOs and their derivatives is done in accordance with the standards of Normative Resolution No. 05 of 12 March 2008 and requires the compliance with other applicable legal obligations. The law further establishes that the commitment to free trade may be suspended or revoked by CTNBio, at any time, should there be any cases of adverse effects on the environment, human and animal health.

*Table 5 Approved GM crops in Brazil*

| Year | Crop | Company |
|---|---|---|
| 1998<br>2006 | GM soybean, Round-up Ready Soybean (GTS 40-3-2)[8] | Monsanto |
| 2005 | GM Cotton, Bollgard Cotton (531) | Monsanto |
| 2007 | GM Corn, Guardian Corn (MON 810) | Monsanto |

[4] *The Seed Law, Law no 10.771, dated August 5, 2003, regulated by Decree no 5.153, July 23, 2004, implemented the National System of Seeds and Plants. Its goal is to guarantee the identity and quality of all material for vegetable multiplication and reproduction that is produced, commercialized and used in Brazil.*
[5] *Law No. 11105 of 24 March 2005*
[6] *Ministry of Science and Technology*
[7] *Website of the Ministry of Science and Technology:* (http://www.agricultura.gov.br/)
[8] *Despite having been approved for commercial use as early as 1998, several lawsuits have prevented the cultivation of RR soybeans. Their commercial use remained officially suspended by a court injunction from 1998 to 2005, The issue related to the effective possibility of the cultivation of GM seeds in Brazil was closed with the new Law on Biosafety on March 24, 2005, which established that CTNBIO was responsible for the analysis, processing and decision on the requirements for any activity related to GMO in Brazil.*

| | | |
|---|---|---|
| 2007 | GM Corn, LibertyLink (Corn T25) | Bayer |
| 2008 | GM Corn, Herculex Corn (TC1507) | Dow |
| 2008 | GM Cotton, Roundup Ready Cotton (MON 1445) | Monsanto |
| 2008 | GM Corn, GA21 Corn | Syngenta |
| 2008 | GM Corn, Roundup Ready 2 Corn (NK 603) | Monsanto |
| 2008 | GM Cotton, LibertyLink Cotton (LLCotton25) | Bayer |
| 2008 | GM Corn, Bt11 Corn | Syngenta |
| 2009 | GM Cotton, Bollgard Cotton (MON 15985) | Monsanto |
| 2009 | GM Cotton, WideStrike Cotton. | Dow |
| 2009 | GM Corn: MIR 162; | Syngenta |
| 2009 | GM Corn Bt11+ GA21 | Syngenta |
| 2009 | GM Corn MON810 + NK603. | Monsanto |
| 2009 | GM Corn MON89034 | Monsanto |
| 2009 | GM Corn TC1507 + NK603 | Dupont Pioneer/Dow |
| 2009 | GM Cotton MON531 + MON 1445 | Monsanto |
| 2009 | GM Soybean CV127 | Basf/Embrapa |
| 2010 | GM Soybean Liberty Link | Bayer |

Source: CTNBio

According to the International Service for the Acquisition of Agri-biotech Applications (ISAAA), for 2009, it was estimated that biotech crops in Brazil occupied 21.4 million hectares, accounting for 16% of all the biotech crops in the world, with 16.2 million hectares containing RR soybeans. According to this organization, the GM technology adoption rate in Brazil was 71%.for the 2009 harvest and had the largest growth rate in the world. (ISAAA, 2009)

Concerning non-genetically modified (NGM) soy, Brazil is also at the top of the list, producing approximately 53% of the world's NGM soy, followed by India and China, which produce 18 and 17% respectively.

*Table 1 – NGM soybean volume – 2009 estimated*

| Country | NGM Soybean Volume Mt. |
|---|---|
| Brazil | 25, 000,000 |
| India | 8, 500,000 |
| China | 8, 000,000 |
| Others | 5, 500,000 |
| Total | 47, 000,000 |

Source: ABRANGE, 2009

Concerned with international requirements, producers and exporters of conventional soy, the **Brazilian Association of Non-Genetically Modified Grain Producers, ABRANGE,** was established in 2008 with the aim of presenting the consumer market, mainly the European market, with non GM grains and by-products, and also to ensure a consistent offer. The organization intends to foster the planting, production development and improved processing of non-GM grains, consolidating the country's position as the main global certified producer of non-GM grains and products.

## 3 RESULTS ON SEED AVAILABILITY

In the seed production chain, firms devoted to genetic improvement, seed multiplication or product commercialization are protected by the regulatory framework. There is an entire legal apparatus that has sprung up around the protection of cultivars developed by these firms, whether conventional or GM. These are more lucrative, since they generate rights to patent payments that do not apply to conventional products.

The Brazilian Association of Soy Producers (APROSOJA) states that: *"Biotechnology is going to be controlled by just one company and when that time comes, this company will be able to set the price they want on their products. Seeds represent higher production cost. Producers may pay from R$ 70 to R$ 200 (US$ 39 to US$ 111) per hectare of seed in some regions of Brazil. This disparity is a major market issue because soon the farmers will want to plant and the varieties will belong to just one company"* (APROSOJA, 2010)

APROSOJA and the Brazilian Association of Non-Genetically Modified Grain Producers (ABRANGE) revealed in 2010 their intention to appeal to the Administrative Council for Economic Defense – CADE (governemental body belonging to the Ministry of Justice), against Monsanto. According to the two entities, the company is restricting farmers' access to conventional (non-GM) soybean seeds."They are imposing a sales ratio of 85% transgenic seeds to 15% conventional seeds"[9]

Data for the offer of conventional seeds in an aggregated manner are not available in Brazil, but there are frequent complaints from farmers associations concerning the scarcity of conventional soybean seeds, although the claims of the farmers are denied by the companies and public agencies responsible for supplying this input. However, not only conventional seeds can become relatively scarce. Seed varieties adapted to specific socio-environmental conditions can no longer be produced, and only commercial varieties sold on a large scale are now viable because the costs of maintaining the technical infrastructure required by law are offset by selling very large quantities of seeds (Santilli, 2009, p. 154).

The Brazilian Association of Seed Producers, Abrasem, does not disclose the market share of leading companies in the sector in the country, but a study by the NGO Centro Ecologico, based on data from the Ministry of Agriculture, provides an overview of the Brazilian market. The concentration zoning for the 2007/2008 season was high in corn, with 58% of the recommended cultivars produced by breeders from only five multinational corporations (Monsanto, Dow, Syngenta, Du Pont and Nidera). In soybeans, the market is more dispersed, with three big companies (Monsanto, DuPont, Syngenta) accounting for 28% of accredited cultivars. Among the GM varieties, however, the supremacy of Monsanto's gene technology is evident since Monsanto technology is included in modified grades of all developers.[10]

This entire context only discourages research on the improvement of conventional cultivars. In Brazil, progress in plant breeding has moved slowly in recent years. Teixeira (2009) states that "*Regarding the applicability of techniques by the breeder itself, in the majority of multinationals in the country, the use of genetic improvement with modern techniques is already routine. However, in the case of higher education institutions most*

[9] Glauber Siveira, APROSOJA President, in http://agenciabrasil.ebc.com.br/home?p_p_id=56&p_p_lifecycle=0&p_p_state=maximized&p_p_mode=view&p_p_col_id=column-4&p_p_col_pos=1&p_p_col_count=3&_56_groupId=19523&_56_articleId=954751

[10] http://zerohora.clicrbs.com.br/especial/rs/zhdinheiro/19,0,2896847,Concentracao-no-mercado-de-sementes-leva-produtores-a-reservar-parte-da-producao-para-replantio.html

*breeding programs have low flexibility and fewer structural conditions in comparison with multinational enterprises when it comes to applying modern techniques at the speed required. …When analyzing the mean percentage of the breeder's titles in the triennium (1996-1998, 1999-2001, 2002-2004, 2005-2007), there has been a gradual reduction in the mean percentage of doctorate degree holders trained in specific programs for breeders' doctors in relation to the average number of people with doctorate degrees trained in Brazil during the same period (from 3.1% to 1.8%)".*

The relative scarcity of conventional seeds, due to prices or even to non availability of local adapted cultivars, is partially solved by the informal seed market that represents approximately 50% of the seed market in the country. Several local farming organizations and government bodies in Brazil, such as the Ministry of Agrarian Development, are developing programs for seeds improvement and local commercialization. However, for when it comes to important commercial crops, such as soybeans and maize, this informal market does not apply. For these crops, farmers are bound to supply chains from which it is difficult to escape. The supply of seeds in these cases is accompanied by a set of inputs, commercialization schemes, financing and insurance to which farmers must submit if they wish to remain in the market.

For other crops, mainly those destined for the food internal market, there are several public and private entities developing research on landraces. There are entities and social movements that work with EMBRAPA on specific projects dealing with the characterization, evaluation and potential commercial destination of cultivars. Seed banks have become an important strategy for providing farmers with access to these cultivars. Public programs specific to family farming, such as seeds exchanges, could make a significant contribution towards to the use of landraces.

EMBRAPA is the public company with the largest germoplasm bank in the world, but today the development of new cultivars depends largely on contributions from private enterprise. EMBRAPA has prioritized cultivar development and licensing in a public and private partnership system, through which it obtains cultivars and maintains initial supplies of genetic and basic seeds for further improvement by accordant private foundations. This whole system depends on control of the farmer's use of cultivars, which should generate enough royalties to support the network of private institutions. Representatives of seed companies and the ministry of agriculture are often combined on the formulation of regulatory mechanisms in Congress. Thus, there is a predominant tendency is to consider the registered seeds as contents of years of research that should be paid for. Consequently the practice of saving seeds for the next crop is condemned by these sectors as a bad cultural habit, although saving seeds is permitted under Brazilian law.

In conclusion, it can be seen that the extension of property rights on seed technology rewards research and innovation, but it is necessary to take into account that farmers' access to the results of this technology is restricted and that alternatives to this process are also limited. Therefore, if agrobiodiversity is a value to preserve and encourage, it is essential to consider the development of policies on the part of both public and nongovernmental organizations to counteract this trend.

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